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CLAIMS:

1. An optical element comprising:

photonic crystal having a refractive index which changes periodically depending on a location of said photonic crystal;

5 wherein:

an angle defined between a first end face and a second end face of said optical element is determined in such a manner that a light beam incident upon the first end face at a predetermined incidence angle and having a predetermined wavelength is emitted from the second end face in a desirable direction.

10 2. An optical element according to claim 1, wherein said photonic crystal includes optical crystal in which a plurality of circular holes are formed in a silicon substrate in a periodic arrangement.

15 3. An optical element comprising:

a first normal optical medium;

a second normal optical medium; and

20 photonic crystal provided between said first and second normal optical media and having a refractive index which changes depending on a location of said photonic crystal;

wherein:

25 said optical deflecting element has a first boundary surface between said first normal optical medium and said photonic crystal and a second boundary surface between said

second normal optical medium and said photonic crystal; and  
an angle defined between the first and second boundary  
surfaces is determined in such a manner that a light beam  
incident upon the first boundary surface at a predetermined  
5 incidence angle and having a predetermined wavelength is  
emitted from the second boundary surface in a desirable  
direction.

4. An optical element according to claim 3, wherein said  
photonic crystal includes optical crystal in which a plurality  
10 of circular holes are formed in a silicon substrate in a  
periodic arrangement.

5. An optical element according to claim 3, wherein a  
material of said first and second normal optical media is the  
same as one of materials which constitute said photonic  
15 crystal.

6. An optical deflection element comprising:  
photonic crystal having a refractive index which changes  
periodically depending on a location of said photonic crystal;  
wherein:

20 said optical deflecting element has a first end face and  
a second end face; and  
a shape of the second end face of said optical deflection  
element is determined in such a manner that a plurality of light  
beams incident upon the first end face at different incidence  
25 angles and having the same wavelength are emitted from the

second end face in different directions corresponding to the incidence angles.

7. An optical deflection element according to claim 6, wherein propagation directions of the plurality of light beams 5 incident upon the first end face are separated from each other in correspondence with the incidence angles, whereas the separated light beams are emitted from the second end face in different directions.

8. An optical deflection element according to claim 6, 10 wherein said photonic crystal includes optical crystal in which a plurality of circular holes are formed in a silicon substrate in a periodic arrangement.

9. An optical deflection element comprising:  
photonic crystal having a refractive index which changes 15 periodically depending on a location of said photonic crystal; wherein:

    said optical deflecting element has a first end face and a second end face; and

    a shape of the second end face of said optical deflection 20 element is determined in such a manner that a plurality of light beams incident upon the first end face at the same incidence angle and having different wavelengths are emitted from the second end face in different directions corresponding to the wavelengths.

25 10. An optical deflection element according to claim 9,

wherein propagation directions of the plurality of light beams incident upon the first end face are separated from each other in correspondence with the wavelengths, whereas the separated light beams are emitted from the second end face in different

5 directions.

11. An optical deflection element according to claim 9, wherein said photonic crystal includes optical crystal in which a plurality of circular holes are formed in a silicon substrate in a periodic arrangement.

10 12. An optical deflection element comprising:

a first normal optical medium;

a second normal optical medium; and

photonic crystal provided between said first and second normal optical media and having a refractive index which changes depending on a location of said photonic crystal;

15 wherein:

said optical deflecting element has a first boundary surface between said first normal optical medium and said photonic crystal and a second boundary surface between said 20 second normal optical medium and said photonic crystal; and

a shape of the second boundary surface of said optical deflecting element is determined in such a manner that a plurality of light beams incident upon the first boundary surface at different incidence angles and having the same wavelength are emitted from the second boundary surface in

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different directions corresponding to the incidence angles.

13. An optical deflection element according to claim 12, wherein propagation directions of the plurality of light beams incident upon the first boundary surface are separated from 5 each other in correspondence with the incidence angles, whereas the separated light beams are emitted from the second boundary surface in different directions.

14. An optical deflection element according to claim 12, wherein said photonic crystal includes optical crystal in 10 which a plurality of circular holes are formed in a silicon substrate in a periodic arrangement.

15. An optical deflection element according to claim 12, wherein a material of said first and second normal optical media is the same as one of materials which constitute said photonic 15 crystal.

16. An optical deflection element comprising:

a first normal optical medium;  
a second normal optical medium; and  
photonic crystal provided between said first and second 20 normal optical media and having a refractive index which changes depending on a location of said photonic crystal;  
wherein:

said optical deflecting element has a first boundary surface between said first normal optical medium and said 25 photonic crystal and a second boundary surface between said

second normal optical medium and said photonic crystal; and

a shape of the second boundary surface of said optical deflecting element is determined in such a manner that a plurality of light beams incident upon the first boundary surface at the same incidence angle and having different wavelengths are emitted from the second boundary surface in different directions corresponding to the wavelengths.

17. An optical deflection element according to claim 16, wherein propagation directions of the plurality of light beams incident upon the first boundary surface are separated from each other in correspondence with the wavelengths, whereas the separated light beams are emitted from the said second boundary surface in different directions.

18. An optical deflection element according to claim 16, wherein said photonic crystal includes optical crystal in which a plurality of circular holes are formed in a silicon substrate in a periodic arrangement.

19. An optical deflection element according to claim 16, wherein a material of said first and second normal optical media is the same as one of materials which constitute said photonic crystal.

20. An optical multiplexing element comprising:

photonic crystal having a refractive index which changes periodically depending on a location of said photonic crystal;

25 wherein:

a shape of a first end face of said optical multiplexing element is determined in such a manner that a plurality of light beams incident upon the first end face at different incidence angles are optically multiplexed with each other along the same 5 direction at a second end face of said optical multiplexing element.

21. An optical multiplexing element according to claim 20, wherein said photonic crystal includes optical crystal in which a plurality of circular holes are formed in a silicon 10 substrate in a periodic arrangement.

22. An optical multiplexing element comprising:  
a first normal optical medium;  
a second normal optical medium; and  
photonic crystal provided between said first and second 15 normal optical media and having a refractive index which changes depending on a location of said photonic crystal;  
wherein:

said optical deflecting element has a first boundary surface between said first normal optical medium and said 20 photonic crystal and a second boundary surface between said second normal optical medium and said photonic crystal; and  
a shape of the first boundary surface of said optical deflecting element is determined in such a manner that a plurality of light beams incident upon said first boundary surface at different incidence angles are optically 25 multiplexed with each other along the same direction at a second boundary surface of said optical deflecting element.

multiplexed with each other along the same direction at the second boundary surface.

23. An optical multiplexing element according to claim 22, wherein said photonic crystal includes optical crystal in 5 which a plurality of circular holes are formed in a silicon substrate in a periodic arrangement.

24. An optical multiplexing element according to claim 22, wherein a material of said first and second normal optical media is the same as one of materials which constitute said photonic 10 crystal.

25. A scanning apparatus comprising:

an optical deflection element including photonic crystal having a refractive index which changes periodically depending on a location of said photonic crystal, said optical deflection 15 element having a first end face and a second end face, a shape of the second surface of said optical deflection element being determined in such a manner that a plurality of light beams incident upon the first end face at different incidence angles and having the same wavelength are emitted from the second end 20 face in different directions corresponding to the incidence angles;

a light source for outputting a light beam having a constant wavelength toward said optical deflection element; and

25 a resonant head for vibrating said optical deflection

element, whereby a light beam deflected by said optical deflecting element is scanned with respect to an object.

26. A scanning apparatus comprising:

an optical deflection element including photonic crystal

5 having a refractive index which changes periodically depending on a location of said photonic crystal, said optical deflection element having a first end face and a second end face, a shape of the second surface of said optical deflection element is determined in such a manner that a plurality of light beams

10 incident upon the first end face at the same incidence angle and having different wavelengths are emitted from the second end face in different directions corresponding to the wavelengths; and

a light source for changing a wavelength of a light beam

15 to be output toward said optical deflection element, whereby a light beam deflected by said optical deflecting element is scanned with respect to an object.

27. A scanning apparatus comprising:

an optical deflection element including a first normal

20 optical medium, a second normal optical medium and photonic crystal provided between said first and second normal optical media and having a refractive index which changes depending on a location of said photonic crystal, said optical deflection element having a first boundary surface between said first

25 normal optical medium and said photonic crystal and a second

boundary surface between said second normal optical medium and said photonic crystal, a shape of the second boundary surface of said optical deflection element being determined in such a manner that a plurality of light beams incident upon the first

5 boundary surface at different incidence angles having the same wavelength are emitted from the second boundary surface in different directions corresponding to the incidence angles;

a light source for outputting light having a constant wavelength toward said optical deflection element; and

10 a resonant head for vibrating said optical deflection element, whereby a light beam deflected by said optical deflecting element is scanned with respect to an object.

28. A scanning apparatus comprising:

an optical deflection element including a first normal  
15 optical medium, a second normal optical medium and photonic crystal provided between said first and second normal optical media and having a refractive index which changes depending on a location of said photonic crystal, said optical deflection element having a first boundary surface between said first  
20 normal optical medium and said photonic crystal and a second boundary surface between said second normal optical medium and said photonic crystal, a shape of the second boundary surface of said optical deflection element being determined in such a manner that a plurality of light beams incident upon the first  
25 boundary surface at the same incidence angle and having a

different wavelengths are emitted from the second boundary surface in different directions corresponding to the wavelengths;

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- a light source for changing a wavelength of a light beam
- 5 to be output toward said optical deflection element, whereby a light beam deflected by said optical deflecting element is scanned with respect to an object.